

AD-A060 273

NAVY UNDERWATER SOUND LAB NEW LONDON CONN
TESTS OF THE POWER-TRONIC SYSTEMS, INC. VDS HEADING REFERENCE S--ETC(U)
JUL 64 R W PIERCE

UNCLASSIFIED

USL-TM-933-190-64

F/G 17/3

NL

| OF |
AD
A060 273



END
DATE
FILMED
12-78
DDC

MOST Project -4

Code 904.2

COPY NO. 20

USL Problem
No. 1-650-01-00

LEVEL II

U. S. NAVY UNDERWATER SOUND LABORATORY
FORT TRUMBULL, NEW LONDON, CONNECTICUT

TESTS OF THE POWER-TRONIC SYSTEMS, INC. VDS HEADING REFERENCE SYSTEM

By

Robert W. Pierce

USL Technical Memorandum No. 933-190-64

2 July 1964

INTRODUCTION

The Power-Tronic Systems, Inc. (PTSI) VDS Heading Reference System was purchased, under Contract NObsr 77626, for use with the AN/SQA-11 Hoist/Transducer Group. Although the heading system was developmental in nature, PTSI agreed to produce the system for a fixed price. Tests have been conducted at ASL, at USL, and on the USS WITEK (EDD-848), but, because of development problems, the system was not installed in the AN/SQA-11 towed body. These tests have shown that the heading system in its present form is unsuitable for VDS use. The system may, with additional development work, have a potential as an accurate heading reference system for VDS and other applications.

EQUIPMENT DESCRIPTION

The heart of the PTSI VDS heading reference system is the compass unit, which occupies less than 1 cubic foot of space. It differs from a conventional gyrocompass in that it has a single degree-of-freedom rate-sensing gyro to sense earth's rotation which provides a heading reference with respect to the earth's rotational axis. Since the rate-sensing gyro is insensitive to earth's rotational rate when its sensitive axis is oriented east and west, the compass is called an "east-seeking gyro compass". The operating principles of the compass are discussed in reference (a).

The compass can be mounted within a VDS towed body and operated remotely by means of a shipboard-mounted heading repeater and power supply. All power for the compass is DC to minimize interference with the sonar. AC power for the gyro and other circuits is generated within the compass unit.

This document has been approved
for public release and sale; its
distribution is unlimited.

AD A060273

DDC FILE COPY

002214

933-190-64

002214

48-15

ASL TESTS

Initial tests of the system were conducted at the USN Applied Science Laboratory in 1962. It immediately became evident that the compass was extremely sensitive to mechanical vibration. The very small vibration associated with the scorsby table, on which the compass was tested, caused the compass to behave erratically. Tests were discontinued until a suitable vibration-isolation mount could be devised. PTSI subsequently designed a rather elaborate isolation mount, which made the compass suitable for testing on the scorsby table. Tests at ASL were completed in mid-1963 and are reported in reference (b).

Reference (a) contains a summary, by PTSI, of the test results as follows:

Static Accuracy (8 hrs.):	0.07 Degrees RMS and spread of 0.3 Degrees.
Repeatability:	0.1 Degrees.
Accuracy Under Conditions of Yaw, Scorsby ($\pm 5^\circ$, 6 cycles/minute):	0.11 Degrees RMS and spread of 1.6 Degrees.
Accuracy Under Conditions of Pitch, Scorsby ($\pm 5^\circ$, 6 cycles/minute):	0.42 Degrees RMS and spread of 1.6 Degrees.
Accuracy Under Conditions of Roll, Scorsby ($\pm 5^\circ$, 6 cycles/minute):	0.49 Degrees RMS and spread of 1.0 Degrees.
Yaw Velocity Error (2° /Second, 11 Revolutions):	Zero Error
Yaw Velocity Error (5° /Second, 6 Revolutions):	Zero Error
Settling Time from 180° :	3 to 4 Hours.

Vibration: The compass was not specifically tested at ASL to ascertain its exact sensitivity to vibration.

USL TESTS

At the conclusion of the ASL tests, BUSHIPS (Code 689A) directed that PTSI deliver the heading system to USL for laboratory and sea tests. The system was delivered with the vibration isolation mount in October 1963.

Laboratory tests consisted of observing the settling of the compass while it was mounted on a test bench. The compass was capable of settling consistently, provided that it was not disturbed by mechanical vibrations, such as those caused by people walking in the vicinity. This extreme vibration sensitivity, even though the PTSI vibration mount was used, indicated that the system would be unsuitable for shipboard use. It was decided, however, to conduct limited shipboard tests to confirm this.

USS WITEK TESTS

The PTSI compass unit, with its vibration-isolation mount, was secured on a test bench located in the after sonar space (Sonar #3) aboard the USS WITEK. The associated indicator unit and power supply were mounted in the U. B. Plot area so that the output of the system could easily be compared with the ship's gyrocompass. A total of 60 data points were taken by the sonar crew at sea from 11 to 20 May 1964. Sea states of 2 or less predominated during this period and ship speed varied between 3 and 22 kts. From figure 1, which is a plot of the test results, it can be seen that the output of the PTSI heading reference system had no predictable relationship with the heading of the ship.

CONCLUSION

The PTSI heading reference system is unable to perform satisfactorily because of its extreme vibration sensitivity. There is indication that the system is capable of good performance in a vibration-free environment.

RECOMMENDATIONS

It is recommended that the existing system not be considered for use with VDS equipments.

It is recommended that reference (a) be reviewed by BUSHIPS (Code 665) and ASL (Code 9350) to determine whether or not additional development work might effect a satisfactory east-seeking gyro VDS heading reference system.

Robert W. Pierce
ROBERT W. PIERCE
Mechanical Engineer

ACKNOWLEDGMENT

Sea tests of the PTSI heading system were conducted by the officers and men of the USS WITEK (EDD-848). The efforts and cooper-

USL Tech. Memo.
No. 933-190-64

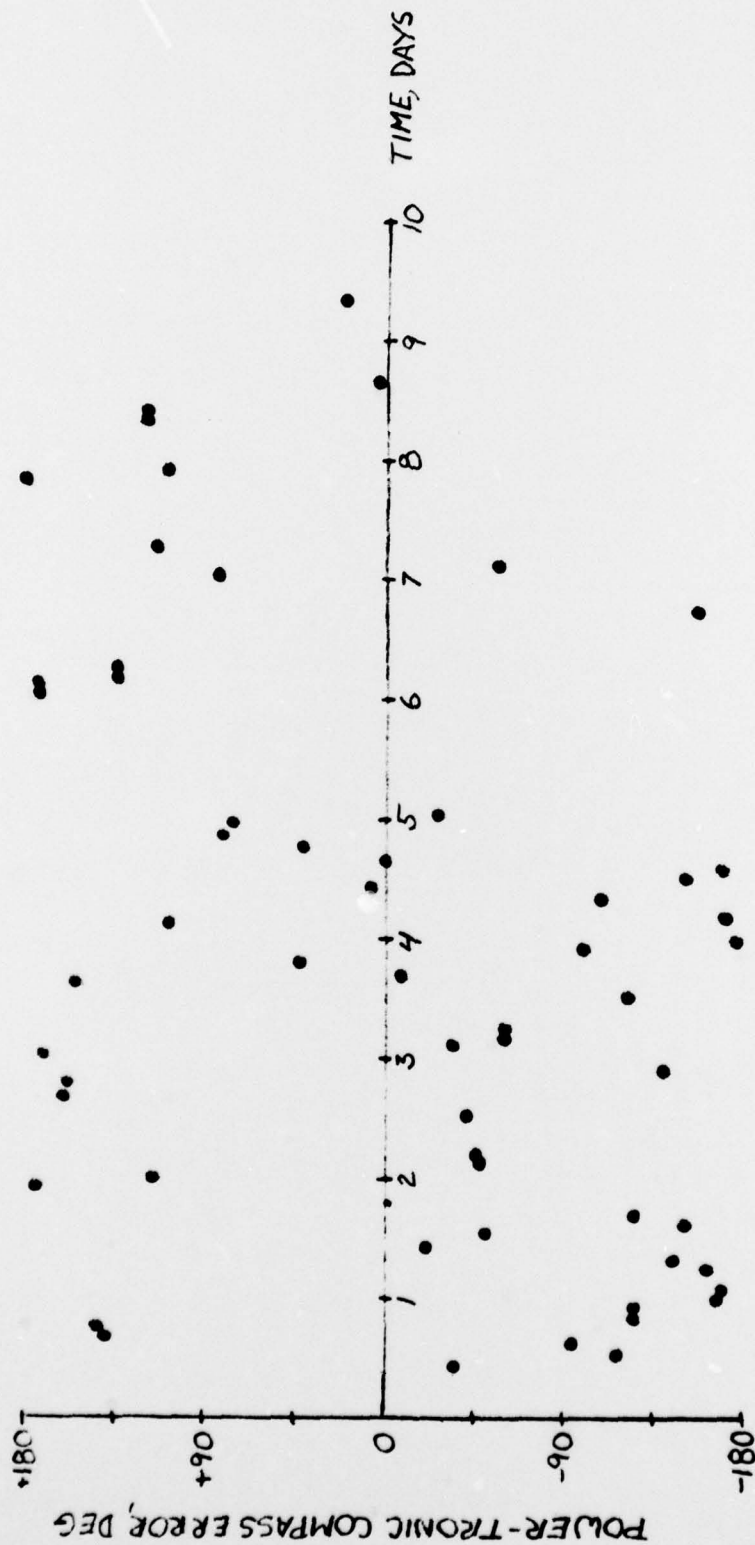
ation extended by: CDR S. T. Hays, Commanding Officer; LT J. M. Murphy, Project Officer; J. Giancarlo, Master Chief Sonarman; and the Sonar Crew are appreciated.

References

- (a) "Proposal for a Pre-Production Model of East-Seeking Miniature Gyro Compass," by Power-Tronic Systems, Inc., September 1963
- (b) ASL Laboratory Project 6318 Progress Report #1 of 2 November 1962 and Final Report of 30 August 1963.

ACCESSION for	
NTIS	White Section <input checked="" type="checkbox"/>
DDC	Buff Section <input type="checkbox"/>
UNANNOUNCED	<input type="checkbox"/>
JUSTIFICATION	<i>Per the</i>
<i>on file</i>	
BY	
DISTRIBUTION/AVAILABILITY CODES	
Dist.	1/ or SPECIAL
<i>A</i>	

OBSERVED ERROR IN POWER-TRONIC SYSTEMS, INC. COMPASS
 USS WITEK (EDD-848)
 11-20 MAY, 1964



USL Tech. Memo. No. 933-190-64 of 2 July 1964

USL Tech. Memo.
No. 933-190-64

Distribution List

External

BUSHIPS (Code 689A) (3)
BUSHIPS (Code 688J)
BUSHIPS (Code 665)

OPNAV (Op-712)
ASL (Code 9350)
CO, USS WITEK (EDD-848)

Internal

Code 100
Code 101
Code 900
Code 900A
Code 900B
Code 900C
Code 930
Code 930A
Code 930S(3)
Code 932
Code 932.2
Code 933
Code 933.2
Code 933.3
Code 902
Code 904
Code 904.2(5)